BIOLOGICAL EVALUATION OF THE NIAGARA RIVER

1968

Ministry of the Environment

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A BIOLOGICAL EVALUATION

of

THE NIAGARA RIVER

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SUMMARY

The quality of water on the Upper Niagara River at the time of this survey was impaired in certain sections. Bottom faunal communities in the vicinity of the Buffalo River mouth and the Tonawanda area were disrupted to a considerable degree; some samples were entirely void of macroinvertebrate life. Pollution problems on this section of the river reflected the impact of the large industrial and urban complex extending from Buffalo to Tonawanda. Just upstream from the Niagara Falls, the waste materials were sufficiently diluted to the point where impairment of the benthos was negligible.

Water on the Lower Niagara River was impaired throughout its entirety, although the impairment was not as severe as it was in many of the local areas above the falls. The depressed faunal conditions on the Lower River were a result of several factors, including the effluent from the sewage treatment plant at Niagara Falls (N.Y.), waste materials remaining from the Upper River, and wastes from the Welland System which discharge through the Ontario Hydro Electric Power Canal. The discharge from the sewage treatment plant at Niagara Falls (N.Y.), (containing 75% industrial wastes), was undoubtedly the major source of impairment on the Lower River. The impact of waste discharges to the Lower River had been felt on the Canadian side as a result of cross-boundary pollution which in the past had given rise to duck mortalities, periodic oil slicks, and taste and odour problems at Niagara-on-the Lake.

The effect of the Niagara River on Lake Ontario was not accurately determined although it appeared that the benthic population in Lake Ontario in the vicinity of the Niagara River mouth was slightly impaired.

Biological impairment on the river was a result of many pollutants from many waste sources. However, there were two major types of pollutants - oils and phenols - which contributed very substantially to the biological degradation. Both oils and phenols were recognized as major pollutants in a report (October, 1967) which was prepared by co-operating agencies for the International Joint Commission and which has since been released publicly by that Commission.

INTRODUCTION

A report entitled 'Summary Report on Pollution Of The Niagara River' October, 1967, has recently been submitted to the International Joint Commission by the Lakes Erie-Ontario Advisory Board. The report provides an excellent documentation of the industries and municipalities discharging waste material to the river. The locations of industries, plus information on the volumes and chemical characteristics of their waste effluents, is provided. The report also describes water quality in the river based on coliform bacteria counts and phenol analyses.

Additional data have been collected by both Canadian and United States pollution-control agencies which provide a more recent documentation of the chemical characteristics of the river.

Owing to the fact that chemical and bacteriological characteristics had already been examined, the present survey, conducted in May and June, 1968, was limited primarily to a study of the benthic fauna. Some chemical analyses were carried out on the sediment samples, however, and a brief investigation was made of the extent of aquatic weed growths in the river.

There have been practically no investigations on the biology of the Niagara River. The Ontario Department of Lands and Forests does have some information on the success and intensity of fishing operations on the river, but it is difficult to relate these data to water quality. The main purpose of the present study was to determine the presence and extent of biological impairment on the river through a detailed investigation of the benthic fauna.

DESCRIPTION OF STUDY AREA

The Niagara River is a 37-mile waterway connecting Lake Erie and Lake Ontario (see Figure 1). The volume of flow averages about 200,000 cubic feet per second and fluctuates little from season to season. The well-known Niagara Falls, located half-way between Lake Ontario and Lake Erie, divides the river into the 'Upper River' (between the Falls and Lake Erie) and the 'Lower River' (between the Falls and Lake Ontario). The Upper River starts off as a very fast flowing watercourse as it passes through a narrow channel (1600 feet wide) at Fort Erie. A short distance downstream from this, the Niagara widens and forms two channels which enclose Grand Island. These channels join again just upstream from Niagara Falls. The water drops 155 feet as it flows over the falls and then enters the Niagara Gorge. At Queenston, Ontario, the river widens and deepens and flows rather slowly along to Niagara-on-the-Lake and into Lake Ontario.

The river bed is mostly bedrock throughout the upper section where the water is quite shallow (maximum depth of 30 feet). The lower part of the river between Queenston

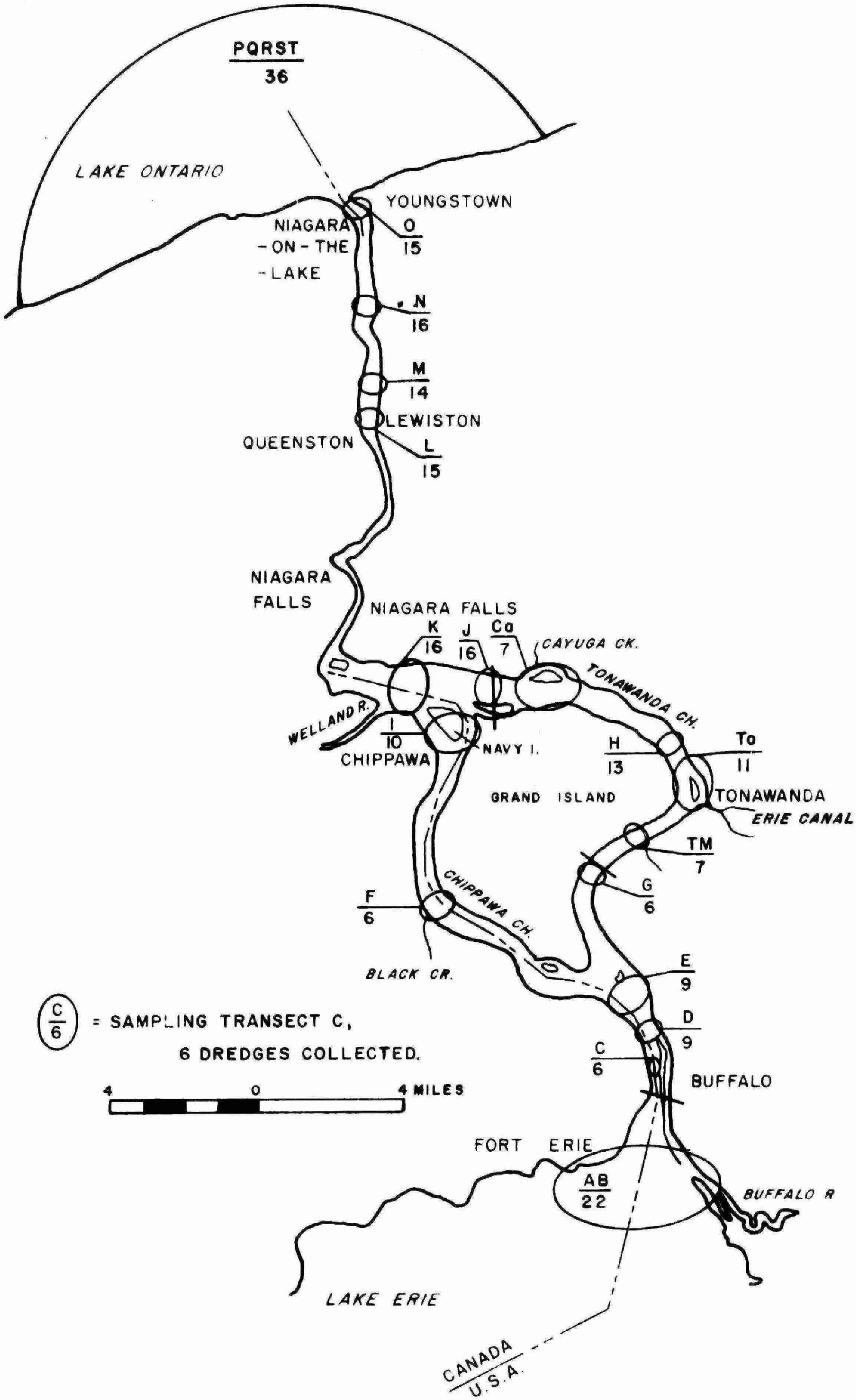

FIG. I NIAGARA RIVER
SAMPLING LOCATIONS.

and Niagara-on-the-Lake is deeper (maximum depth of 50 feet), flows more slowly and, in general, has a mud bottom.

Most of the urban and industrial development on the river is located on the New York State side. The city of Buffalo is located at the head of the river. Buffalo discharges approximately 145 million gallons per day of municipal waste to the Niagara River. The city is quite heavily industrialized and several chemical, oil and steel industries discharge their waste material to the Buffalo River which then flows into the Niagara. The large Bethlehem Steel Corporation plant is located at the south end of Buffalo.

Across the river from Buffalo is the town of Fort Erie, Ontario, which discharges 1.5 * mgd of treated municipal sewage. Industries in the Fort Erie area discharge only small volumes of wastes to the river, including Gould National Batteries of Canada Ltd., and the Canadian National Railway Company Depot. Hooker Chemical Nanaimo Ltd., (Fort Erie) discharges only cooling water to a municipal storm sewer. Fleet Manufacturing Ltd., discharges treated wastes to Frenchman's Creek which empties into the Niagara just downstream of Fort Erie. Riverdale Frozen Foods Ltd., discharges cooling water containing a small amount of treated wash water (BOD, suspended solids, and ether solubles) directly to the Niagara River between Fort Erie and Chippawa.

On the New York side of the river, the urban complex of Tonawanda (see Figure 1) discharges a total

* million gallons per day

municipal waste volume of approximately 20 mgd. The area extending from Buffalo to Tonawanda is heavily industrialized, having steel, chemical and oil industries which discharge a combined waste loading of about 70 mgd to the river. The Tonawanda complex as well as the stretch of river between Tonawanda and Niagara Falls is also quite heavily industrialized, including several chemical industries. The City of Niagara Falls, N. Y., presently discharges both its sanitary sewage and most of its industrial waste through the municipal sewage treatment plant. The sewage passing through the plant (70 mgd) consists of 75% industrial waste by volume. The plant is highly overloaded and provides very little treatment to the waste prior to discharge. Owing to the lack of industrial and urban development between Niagara Falls and the river mouth, discharges on the American side in this section are negligible.

Niagara Falls, Canada, contributes a total municipal waste loading of 3.6 mgd of primary-treated effluent to the Welland River and Ontario Hydro Electric Power Canal which combine and discharge into the Lower Niagara River near Queenston. While there are several industrial effluents entering the Welland River (totalling about 30 mgd), the major discharge comes from Cyanamid of Canada Ltd., (Welland Plant). This plant discharges some 5½ tons per day of free ammonia, 3½ tons of nitrate and 13½ tons of kjeldahl nitrogen.

BIOLOGICAL EVALUATION OF WATER QUALITY

An investigation of the bottom invertebrate population provides a long-term indication of water quality. A toxic waste will eliminate all or part of the invertebrate population and owing to the lack of mobility and slow reproductive rate of benthic invertebrates, the effects caused by one toxic 'slug' of waste will persist for months. In this sense, the benthic community structure provides a measure of water quality not afforded by periodic chemical sampling. Also, the types of organisms found in the aquatic community provide a general indication of the type of pollutant causing impairment. For example, a population dominated by large numbers of sludgeworms indicates organic pollution. A very sparse population characterized by few species indicates toxic chemical pollution.

The present survey was not sufficiently detailed so that the effects of each waste effluent could be evaluated. A sufficient number of samples were collected, however, to map out those areas of the river where abnormal benthic communities resulted from impairment associated with urban and industrial complexes.

METHODS

A total of 144 samples were collected on the Upper Niagara, 60 samples on the Lower Niagara and 36 samples in Lake Ontario near the river mouth. These samples were collected at 17 pre-selected transects on the river and along

five transects radiating out into Lake Ontario (see Figure 1). The number of samples collected from each transect ranged from six to 22, depending mainly on the type of bottom. The locations of most of the transects corresponded with those that are being used to monitor water quality for the International Joint Commission.

After collecting the samples with a Ponar dredge (8½" x 9½"), the invertebrates were separated from the sediment using a 24-mesh-per-inch screen (0.65 mm aperture). The organisms were preserved in 95% ethanol and subsequently returned to the laboratory for enumeration and identification.

To supplement the results obtained by dredging, 'artificial substrates' were used to obtain information where the use of the Ponar dredge was impractical because of the rocky bottom or rapid current. These artificial substrates were box-shaped wire cages (6" x 8" x 8") containing two-inch crushed limestone which became populated by the invertebrates present at the location. The substrates were allowed to rest on the river bottom for four weeks. They were removed and the attached organisms were brushed off and preserved in 95% ethanol. Unfortunately, many of the floats marking the substrates were lost as a result of tampering; others became overgrown with aquatic weeds and could not be found. However, the nine substrates which were retrieved did yield valuable information.

Visual characteristics of the sediment were noted at each of the 240 stations sampled with the Ponar dredge.

RESULTS

General

Because of the large areas of rocky bottom in the river, difficulty was often encountered in obtaining sediment samples with the Ponar dredge. At many sampling locations, only a few small rocks or small quantities of sand or gravel were found in the dredge. However, even these were retained as samples providing at least one macroinvertebrate was found. The benthic population at many of the stations must therefore be viewed as strictly qualitative. Quantitative evaluations can be made only in those areas where the dredge was almost full of sediment (approximately 12% of the stations).

The stretch of river which comprised the Niagara Gorge between the Falls and Queenston could not be sampled owing to the extreme current velocity. The only information for this area was obtained by using artificial substrates above and below the effluent from the sewage treatment plant at Niagara Falls (N. Y.).

The present report does not contain an appendix listing the types and numbers of organisms found at each sampling location. This information, as well as a map illustrating the exact location of each sampling station, is available from the Biology Branch, OWRC Laboratory, P. O. Box 213, Rexdale, Ontario.

Transect AB - Buffalo

A total of 22 dredge samples (Figure 1) were collected from transect AB. The benthic population on the Canadian side of the river contained a variety of species,

including pollution-sensitive caddisflies, mayflies and midge flies; caddisflies and amphipods dominated the population. On the United States side of the river, however, the benthic community was restricted to pollution-tolerant organisms, most of which were sludgeworms and snails. One sample, collected at the mouth of the Buffalo River, was void of organisms, indicating toxic conditions.

Transects C, D and E - Fort Erie

Samples from transects C, D and E indicated similar differences in water quality from the west to east side of the River. The benthic community on the west side contained a wide variety of species with the population being dominated by caddisflies (*Hydropsyche* and *Cheumatopsyche*). Sludgeworms in the population were characterized by low numbers and a wide variety of species. Samples collected from the east side of the river contained quite different invertebrates; sludgeworms dominated the population and only a few species were found, almost all of which were pollution-tolerant.

Transects G and TM - Tonawanda Channel

Transects G and TM supported a benthic population dominated by pollution-tolerant species. However, caddisflies were common on the Grand Island side of these transects and some caddisfly specimens were found on the east side of the channel. The benthos in this area indicated that the quality of water was somewhat better than that further upstream along the U. S. side. Also, the benthic community structure varied little from one side of the channel to the other.

Transect TO - Tonawanda

A total of 11 dredge samples were collected in this area to determine the effect of the Tonawanda area on the benthos. With the exception of one sample, samples collected between Tonawanda Island and Grand Island supported a slightly restricted population similar to that found at transects G and TM. One station, located about 100 feet west of Tonawanda Island, was void of organisms, indicating heavy pollution. Samples collected in the narrow channel east of Tonawanda Island contained a restricted community of pollution-tolerant organisms. Two of the samples, one located near the mouth of the Erie Canal, were void of organisms.

Transect H - North Tonawanda

A total of 14 dredge samples were collected in this area. The invertebrate community was similar on both sides of the channel. A fair variety of organisms was found, but pollution-sensitive species had not recovered indicating that some impairment still existed.

Transects CA and J - Cayuga

Samples collected from these two transects indicated only slight water quality impairment. The benthos was similar on both sides of the channel and the species diversity was only slightly more restricted than that found in the Chippawa Channel. Two stations located near the mouth of Cayuga Creek, however, had high numbers of pollution-tolerant sludgeworms.

Transects F and I - Chippawa Channel

A total of 16 samples collected from these two transects revealed that the Chippawa Channel contains a wide variety of benthic organisms, many of which are pollution-sensitive. Caddisflies, mayflies and amphipods are common in this area and the channel is rich in its supply of fish-food organisms.

Transect K - Chippawa

The invertebrate community in this area is quite uniform from one side of the river to the other and is represented by a well-balanced community with many clean-water species.

Transects L, M, N, O - Lower Niagara

A total of 45 dredge samples were collected from the Lower River. The bottom faunal population was very similar from area to area throughout this section of the river. Snails, fingernail clams and sludgeworms dominated the population and other organisms, such as leeches and amphipods, were fairly common. However, water quality impairment was indicated by 1) the absence of pollution-sensitive mayflies, 2) the scarcity of caddisflies and 3) the restricted variety of species of sludgeworms and midge flies. The similarity in benthic populations throughout the Lower River is partially a result of the uniform mud bottom but further demonstrates that impaired water quality is prevalent below Niagara Falls.

Transects P, Q, R, S, T - Lake Ontario

A total of 36 benthic samples were collected in Lake Ontario near the Niagara River mouth (Figure 1). The population structure in this area is similar to that found on the Lower River except that the samples from Lake Ontario contained fewer sludgeworms and more fingernail clams. The lake samples were difficult to interpret because of the natural changes brought about by sediment deposition in this area. However, the results indicated that any direct impact of the Niagara River on the benthic fauna of Lake Ontario is relatively minor.

Comparisons between the Upper and Lower River

Several interesting comparisons can be made between the benthic population found in the Upper River and that found in the Lower River (see Figure 2).

Mayflies, which in general are indicative of clean water, were found to be sparse on the Upper River and were not found on the Lower River or in Lake Ontario near the river mouth. On the Upper River, mayflies were found at eight stations, seven of which were on the Canadian side.

Caddisflies are common throughout most of the Upper River and attain fairly dense populations (over 100 per dredge) where favourable substrates exist. A total of eight genera were found, with Hydropsyche and Cheumatopsyche being the most common and abundant. Approximately 75% of the samples collected on the Canadian side of the Upper River contained caddisflies, while only 27% on the United States side contained

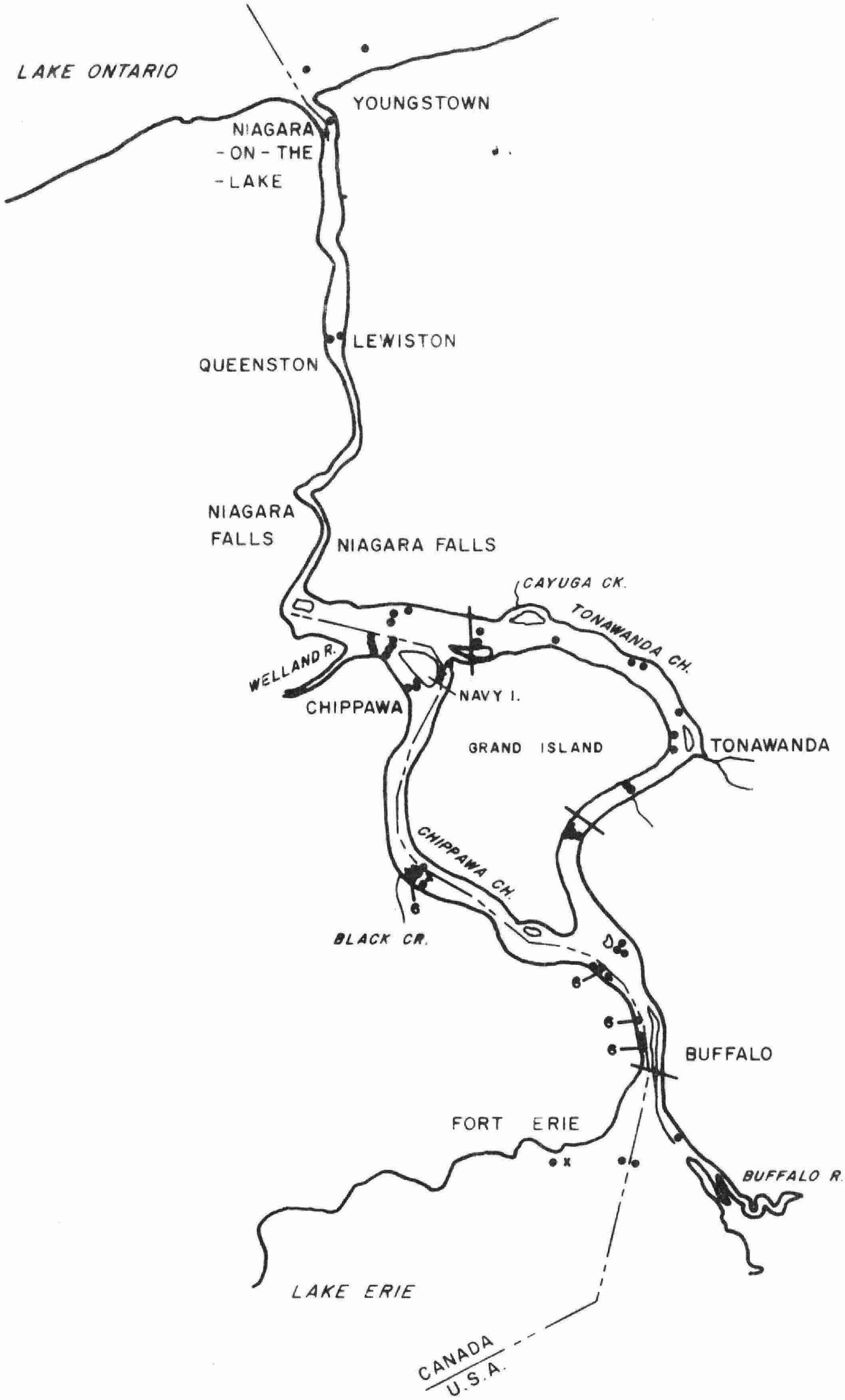

FIG. 2 DISTRIBUTION OF CADDISFLIES AND MAYFLIES ON THE NIAGARA RIVER.

• CADDISFILIES

x MAYFLIES

4 0 4 MILES

this group. Caddisflies are relatively uncommon in the Lower River; only four of the 60 samples collected contained this group. Three of these samples contained one specimen each of Hydropsychidae; the fourth contained two specimens of Hydropsychidae. Only two of the 36 samples from Lake Ontario contained caddisflies.

Pollutants in the sediment

In some of the sediment samples, pollutants were in sufficient concentrations to be distinctly visible to the unaided eye.

Visually, the most obvious pollutant in the sediment is oil (Figure 3). Sediment samples from a total of eighteen stations on the Upper River and nine stations on the Lower River had a distinct oily appearance. The eighteen stations on the Upper River were all on the United States side, while those on the Lower River were scattered throughout. Most of the stations in the vicinity of the Buffalo River mouth contained a visual amount of oil in the sediment. Most of the other samples on the Upper River containing oil bordered the New York mainland. On the Lower River, samples containing a visible oil content presented no distribution pattern; samples with oil were scattered throughout this area and it is assumed that oil on the Lower River is in sufficient concentrations to become visually apparent wherever a suitable sediment for concentrating the oil exists.

Wood and iron particles were visible in the sediment samples at some stations in the Tonawanda Island area.

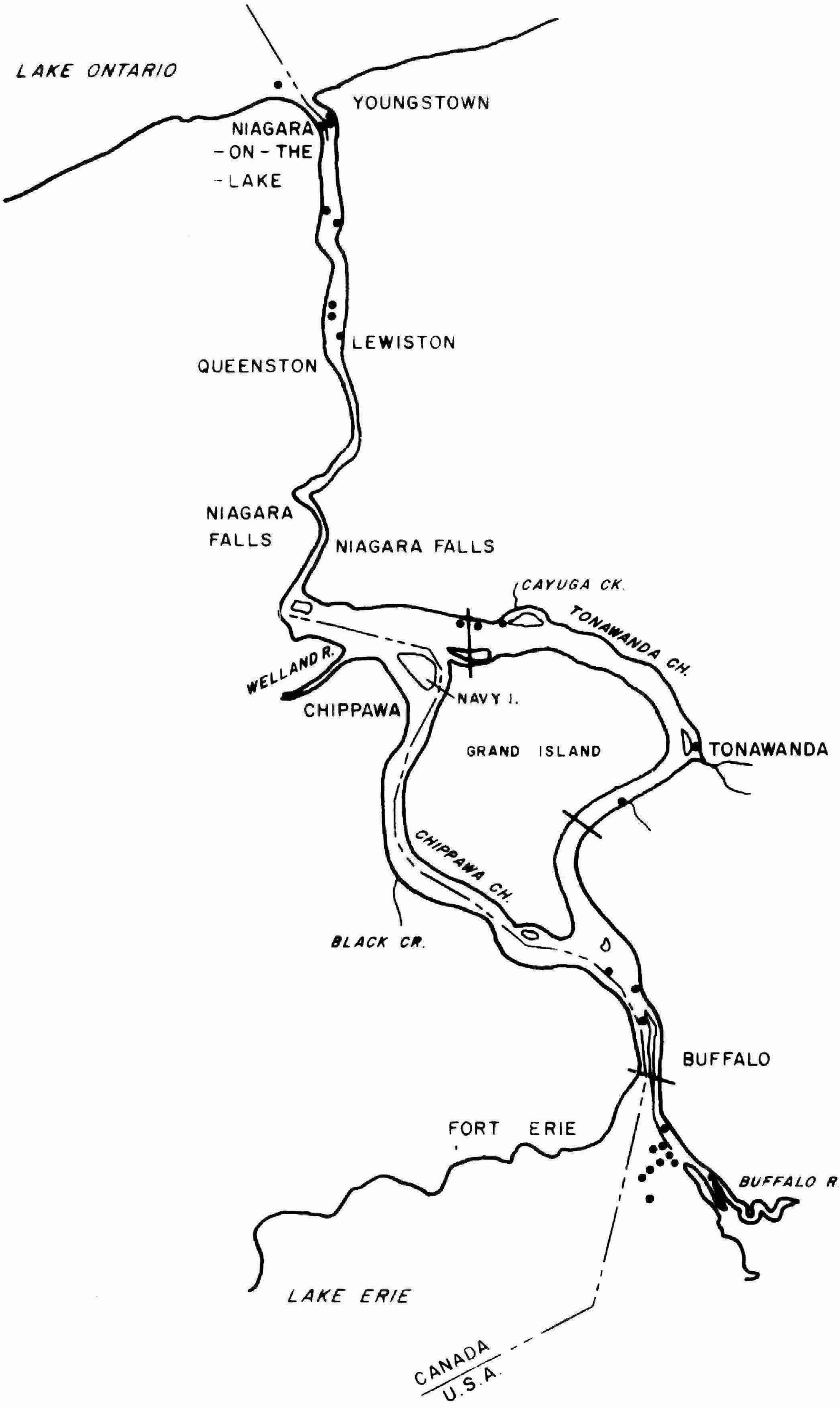

FIG. 3 SAMPLING STATIONS ON THE NIAGARA RIVER AT WHICH OIL WAS VISUALLY OBSERVED IN THE SEDIMENT.

In order to investigate the possibility that waste discharges from a battery plant (Gould National Batteries of Canada Ltd.) in Fort Erie were polluting Niagara River sediments, sediment samples were collected for lead, zinc and copper analyses. Five samples (Gould 1 to 5, Table 1) were collected in the river within 200 feet of the ditch which carries the waste effluent from the company. Analyses were also conducted on several upstream control stations, although the results of only one control station are presented in Table 1. The analytical results demonstrate that these metals are fairly normal for river sediments although there is evidence of some increase in lead content near the ditch carrying wastes from Gould National Batteries. The lead build-up does not appear to be a major problem, and is restricted to a very small area.

Table 1. Concentrations of lead, zinc and copper in sediment samples collected in the Niagara River in the vicinity of waste discharge of Gould National Batteries Limited. Results are expressed in parts per million of dry, ignited (635°C) sample weight.

	Gould 1	Gould 2	Gould 3	Gould 4	Gould 5	Stn. A5 (Control)
Pb	180	150	212	12	11	58
Zn	80	100	156	103	61	418
Cu	-	100	114	28	36	101

However, the potentially damaging effects of lead on aquatic life at low concentrations and its cumulative properties must be appreciated so that these results should not be considered as insignificant.

Aquatic vegetation

Both the Upper River and Lower River have numerous indentations along the shoreline which provide suitable areas for the growth of rooted-aquatic vegetation. These 'sheltered' areas are removed from the main river flow and allow a mud sediment to become established. Many of these areas support heavy growths of a variety of species, including Canada water weed (*Anacharis canadensis*), milfoil (*Myriophyllum* sp.), tape grass (*Vallisneria americana*), Richardson's pondweed (*Potamogeton richardsonii*), and narrow-leaf pondweed (*Potamogeton* sp.).

Because of the rapid water flow and extensive rock bottom throughout most of the river, the patches of vegetation are small and therefore present only minor problems to boat traffic, recreational usage and aesthetics.

DISCUSSION

There is a wide variation in the physical characteristics of the benthic habitats throughout the river. Variations in sediment types, river flow, depth and vegetation provide a variety of natural habitats for macroinvertebrates reflected by differences in benthic community structures. Caution must therefore be taken in relating the benthic findings to water quality. Attention is drawn to areas where disrupted benthic communities relate to water quality effects (see Figure 4).

The source of the Niagara River, i.e. Eastern Lake Erie, has been described as being 'moderately oligotrophic'

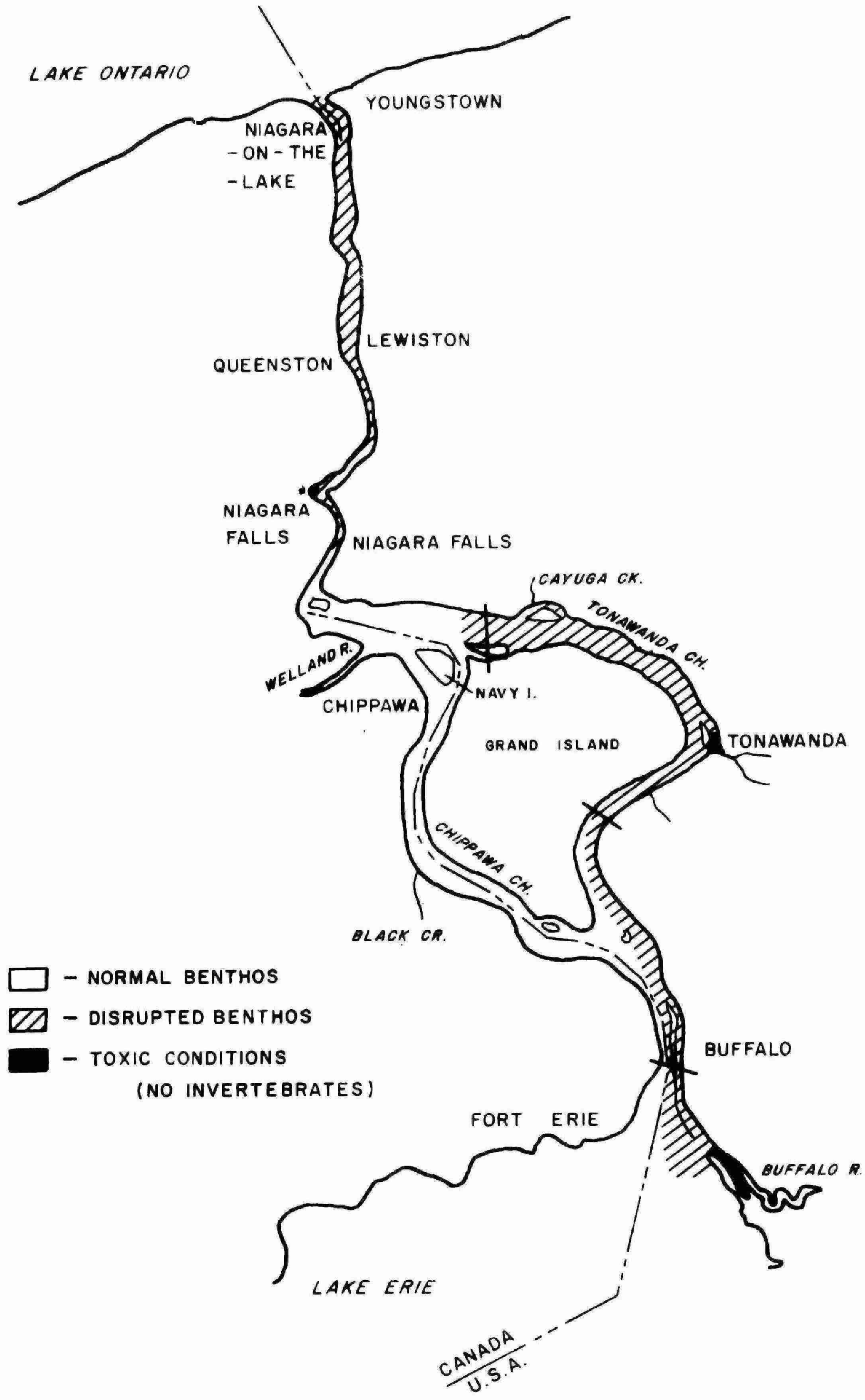

FIG. 4 BENTHIC COMMUNITY STRUCTURE.

4 0 4 MILES

by Hamilton (Brinkhurst, R. O., A. L. Hamilton and W. B. Herrington, 1968). The present survey revealed that water at the origin of the Niagara River (except for the Buffalo River mouth area) is of good quality while the water at the mouth of the river is impaired. In general, the Lower River is impaired throughout, while the Upper River is impaired only in specific areas. Water on the Canadian side of the Upper River is of good quality, while the water along a considerable portion of the United States side (i.e. in the Buffalo and Tonawanda area) is affected by pollutants. Water quality in two areas along the Upper River is seriously impaired as discussed below.

Upper River

Water quality on the Canadian side of the Upper River is good. No impairment was suggested by any of the benthic populations and it can be assumed that the small industries located in the Fort Erie area are not impairing fauna in the river to a detectible degree. The one problem appears to be a minor build-up of lead in the Niagara River immediately adjacent to the mouth of the creek carrying wastes from Gould National Batteries of Canada, Ltd.

The Canadian National Railway Company Depot at Fort Erie has, in the past, been responsible for the escape of oil from their yard to the Courtwright Street storm sewer and consequently to the Niagara River. The company, however, has recently installed an oil interceptor which appears to be functioning satisfactorily. Bottom fauna samples collected in the area of the Courtwright Street storm sewer discharge showed no evidence of impairment.

Similarly, the Fort Erie sewage treatment plant, which provides primary treatment to a waste volume of approximately 1.5 mgd, has no noticeable effect on the river.

Much of the river on the U. S. side contained water of poor quality. Impairment was quite extensive, with the Buffalo River mouth area and the Tonawanda Island area being the most seriously impaired. Samples collected on the eastern side of transect A (Figure 1) contained only pollution-tolerant organisms. One sample collected just upstream from the Buffalo River mouth was void of organisms. While the benthic impairment in this area is due to several pollutants, oil is expected to be of major significance, as it was observed in most of the mud samples from the Buffalo River mouth area. An oil slick was noted at the mouth of the Buffalo River during each of the four days this area was visited in the present study. Periodic oil slicks were observed just outside the Buffalo River mouth and along the Buffalo side of the Upper River. Many of the Buffalo industries discharge to the Buffalo River and while it has a relatively low flow of 525 cfs (yearly average), periodic rainstorms have been known to wash the polluted water into the Niagara River source causing oil slicks and impairment on the U. S. side of the Upper Niagara River. Water quality in the area of transects C, D and E (Figure 1) was impaired only on the United States side. Most of the pollutants causing this impairment no doubt come from the Buffalo River, although the Buffalo Sewage Treatment Plant located on Squaw Island contributes to this impairment (effluent from the plant is about 143 mgd).

Between Buffalo and Tonawanda, an industrial complex includes oil refineries and chemical and steel industries which discharge at many places along the east side of Tonawanda Channel. The locations and effluent characteristics are well described in 'Summary Report on Pollution of the Niagara River'. Waste materials discharged from the Buffalo area plus the additional waste materials from the Buffalo to Tonawanda industrial complex cause impairment of the benthic community along the east side of the Tonawanda Channel. On the west side of this channel, only minor impairment was detected.

Samples collected around Tonawanda contained an impaired benthos. Three of the samples were void of macro-invertebrates. Several large industries in the Tonawanda area contribute to this impairment. The International Paper Company, located on Tonawanda Island, discharges a volume of about 9.3 mgd. The Continental Can Co., Inc., (Tonawanda) discharges 3 mgd.

The Buffalo-Tonawanda complex is therefore the major cause of pollution on the Upper River. This study was not sufficiently detailed so that the extent of impairment from each United States waste effluent would be demonstrated on an individual basis. Because of the density of industrial and municipal waste effluents in the Buffalo to Tonawanda area, water quality impairment is brought about by the additive effect and interactions of all the major effluents. The waste materials largely remain on the east side of the river until the Tonawanda area is reached. Beyond Tonawanda, the waste materials seem to become distributed to the west

side of the channel, and by the time Cayuga is reached, the pollutants are sufficiently diluted and purified so that hardly any impairment is noticed just above the falls.

Lower River

The Lower River, unlike the Upper River, is impaired throughout its length and width. While there are no areas severely affected by pollution, there is no part of this section which is 'clean'. Because of the differences in benthic community structure between sampling area K on the Upper River, and Queenston, it is evident that waste materials entering the river between the Falls and Queenston are largely responsible for biological impairment on the Lower River. The major waste discharge entering this section of the river comes from the Niagara Falls (N. Y.) sewage treatment plant. This plant discharges approximately 70 mgd, 75% of which is industrial waste. The plant is highly overloaded and provides only a small amount of waste treatment and removal. It is therefore of little doubt that this effluent is largely responsible for biological impairment on the Lower River.

In order to evaluate the immediate effects of the effluent from the sewage treatment plant at Niagara Falls (N. Y.) on the river, artificial substrates were placed on the United States side of the river at distances of 100 yds, 200 yds and 1200 yds downstream from the plant effluent. The substrate located 100 yds from the plant was void of macro-invertebrates and the two located at 200 yds and 1200 yds both contained abnormal populations with pulmonate snails

dominating the population. It is therefore evident that even with the large dilution capacity of the river, the benthic population is considerably affected at a distance of 1200 yds from the outfall. Substrates placed in the rapids area of the Canadian side of the river contained few snails and a well-balanced invertebrate population which consisted of midge larvae, cranefly larvae, caddisfly larvae, snails, flatworms, amphipods and enchytraeid worms.

A second significant source of pollution to the Lower River is the Welland River which enters the Niagara via the Hydro Electric Power Canal near Queenston. As mentioned previously, conditions in the river did not allow sampling of the benthic communities immediately above and below the entrance of the Ontario Hydro Electric Power Canal. Waste materials entering the Welland total some 30 mgd with Cyanamid of Canada Ltd. (Welland Plant) being the main contributor. However, these wastes receive considerable dilution and purification before entering the Niagara River.

Biological impairment on the Lower River is evidenced by the absence of mayfly nymphs, the scarcity of caddis larvae and the small variety of worms and midges. The benthos of the Lower River has no doubt been disrupted by several pollutants. Oil, most of which probably comes from sources on the Upper River, no doubt plays a significant part in disrupting the bottom fauna. Other pollutants, such as phenols, add to the disruption. Niagara-on-the-Lake must treat their water with activated carbon to rid the water of tastes and odours; phenols are known to provide tastes and odours at very low concentrations.

It appears that wastes from Niagara Falls, N. Y., enter the river before it has completely cleansed itself from wastes gaining access to the upper stretches. The effluent from the sewage treatment plant at Niagara Falls (N.Y.) is the major cause of the disrupted invertebrate community on the Lower River, although wastes from the Welland System as well as those remaining from sources on the Upper River add to this impairment.

Effect of the Niagara River on Lake Ontario

A total of 36 bottom samples taken in Lake Ontario extending out from the river mouth about four miles indicated that some impairment was present in this part of the lake. Impairment in this area, however, is difficult to evaluate because the continuous deposition of solids from the river provides a natural factor in disrupting the natural lake benthos. However, the bottom fauna appears to be disrupted more than would be expected near the mouth of a river carrying good-quality water.

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